ABSTRACT

Elevated CO_2 and global warming might impart counteractive effects on wheat, a temperature-sensitive C_3 crop, especially under the warm sub-tropical conditions. Therefore, field experiments are necessary to assess the impact of elevated CO_2 and concomitant rise in temperature on wheat production for the development of location-specific suitable agro-adaptations under the sub-tropical climate. The objective of this study was to investigate the effect of CO_2 elevation in combination with varying nitrogen management on growth, physiological responses, and grain yield and quality of wheat in sub-tropical India. In addition, the changes in soil fertility were also analysed. Wheat crop was grown in open field, and inside the open top chambers (OTC) with ambient CO_2 (400 μmol mol^{-1}) and elevated CO_2 (50% higher than ambient) environment with four nitrogen (N) management during the cool and dry *rabi* season of 2015 and 2016 at Kharagpur, India. The N management were: no-fertilizer, application of N at normal and 50% higher dose through chemical fertilizer (CF), and the higher dose through integration of organic fertilizer with CF. The results stated significant increase in biomass with enhanced photosynthetic carbon assimilation and thereby grain yield (~17%) of wheat under the elevated CO_2 environment as compared to the ambient environment in OTC. On the other hand, the elevated CO_2 in conjugation with higher N dose through CF led to a significant decrease in total phenolic content and antioxidant activities in leaves. The elevated CO_2 also affected the grain quality by decreasing the content of protein (up to 8%), P (7%), Mg (7%), Ca (8%), Zn (15%), and Fe (20%) as compared to the ambient environment. The adverse effect, however, was managed through higher dose of N application (CF or integrated sources), which brought improvement on grain quality by increasing starch, protein and other nutrient contents. Soil nutrient availability such as NH_4-N, NO_3-N, Fe, Mn, and Zn content decreased, but P content and microbial population increased significantly with the CO_2 elevation. The results suggested the need of efficient and balanced nutrients management in future climate scenarios for improvement in the wheat grain yield and quality as well soil fertility in sub-tropical India.

Keywords: Antioxidant activity, Elevated CO_2, Grain quality, Nitrogen management, Soil fertility, Wheat, Yield